

1967

Consumer Evaluation of a New Low-Fat Spread-Type Dairy Product

Walter W. Wosje

Follow this and additional works at: <http://openprairie.sdstate.edu/etd>

 Part of the [Dairy Science Commons](#)

Recommended Citation

Wosje, Walter W., "Consumer Evaluation of a New Low-Fat Spread-Type Dairy Product" (1967). *Theses and Dissertations*. 1263.
<http://openprairie.sdstate.edu/etd/1263>

This Thesis - Open Access is brought to you for free and open access by Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange. For more information, please contact michael.biondo@sdstate.edu.

**CONSUMER EVALUATION OF A NEW
LOW-FAT SPREAD-TYPE DAIRY PRODUCT**

BY

WALTER W. WOSJE

This thesis is a report of an independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree, but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Advisor

Date

Head, Dairy Science Department

Date

**A thesis submitted
in partial fulfillment of the requirements for the
degree Master of Science, Department of Dairy
Science, South Dakota State
University**

1967

SOUTH DAKOTA STATE UNIVERSITY LIBRARY

**CONSUMER EVALUATION OF A NEW
LOW-FAT SPREAD-TYPE DAIRY PRODUCT**

The author wishes to express his appreciation and gratitude to Associate Professor Kenneth A. Springer for his time, effort, and encouragement given during this graduate program and for his guidance and assistance in the preparation of this thesis.

The author expresses special thanks to Dr. J. P. ... for his helpful in setting up the Consumer ...

This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree, but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Certificate is

given for the grade

Thesis Adviser

Date

and for his help in the preparation of the consumer survey.

Dr. Robert Beck, Jr.

deserves credit for **Head, Dairy Science Department** **Date**

similar survey and for his advice in the selection of the 50 families utilized in this project.

Appreciation is expressed to all members of the instructional, research, and clerical staff of the

ACKNOWLEDGEMENTS

The author wishes to express his appreciation and gratitude to Associate Professor Kenneth R. Spurgeon for his time, effort, and encouragement shown during this graduate program and for his guidance and assistance in the preparation of this thesis.

The author accords special thanks to Dr. D. F. Breazeale, who was instrumental in setting up the Consumer Evaluation Project and to Dr. R. J. Baker for his encouragement and comments in the final preparation of this thesis. Special thanks is given also to Dr. W. L. Tucker, Experiment Station Statistician, who was primarily responsible for the analysis of the data compiled in the consumer evaluation project.

Gratitude is given to Assistant Professor Shirley W. Seas for the production of the product used in the project and for his help in the preparation of the consumer survey. Dr. Robert Beck, Assistant Professor of Economics also deserves credit for his help in the preparation of the consumer survey and for his advice in the selection of the 50 families utilized in this project.

Appreciation is expressed to all members of the instructional, research, and clerical staff of the

Department of Dairy Science, and to fellow students who provided suggestions, assistance, and constructive criticisms of this research project.

ACKNOWLEDGMENTS	WWW
PREFACE	2
LIST OF ABBREVIATIONS	3
History of Food Evaluation	3
Problems in the Low-Fat Spread Industry	7
Objectives of the Study and General Description of Trials	11
EXPERIMENTAL	20
Materials	20
Oil-Insoluble Constituents	20
Variations in Kind of Water-Insoluble	20
Variations in Salt Levels	24
Variations in Type of Emulsifier Used	29
Salt With and Without Emulsifier	30
Variations in Stabilizer Levels	33
Use of Milk Protein Preparations	34
Use of Various Kinds of Stabilizers	36
Use of Synthetic Flatter Material	38
Emulsifier	40
SUMMARY AND CONCLUSIONS	48
LITERATURE CITED	52
APPENDIX	55

TABLE OF CONTENTS

	Page
INTRODUCTION	1
OBJECTIVES	2
PROCEDURE.	2
REVIEW OF LITERATURE	5
History of Food Evaluation.	5
Previous Work on Low-Fat Spread Product	7
Introduction of New Foods and Consumer Acceptance Trials	13
EXPERIMENTAL	24
First Phase	24
Color variations	24
Variations in kind of whey powder.	26
Variations in salt levels.	28
Variations in type of culture used	29
Lots with and without commercial starter distillate	31
Variations in stabilizer levels.	33
Use of milk protein preparations	34
Use of various kinds of stabilizers.	36
Use of synthetic flavor material	38
Second Phase.	40
SUMMARY AND CONCLUSIONS.	48
LITERATURE CITED	52
APPENDIX	55

LIST OF TABLES

(Continued)

Table	Page
1. Factors which influence selection and acceptance of food.	16
2. Ratings of spread-type dairy product as affected by color variation	25
3. Ratings of spread-type dairy product as affected by the use of Cheddar and Cottage cheese whey powder.	27
4. Ratings of spread-type dairy product as affected by variations in salt level.	28
5. Ratings of spread-type dairy product as affected by the use of different cultures	30
6. Ratings of spread-type dairy product as affected by starter distillate.	32
7. Ratings of spread-type dairy product as affected by variation in stabilizer level	34
8. Ratings of spread-type dairy product as affected by use of added milk protein concentrate.	36
9. Ratings of spread-type dairy product as affected by various types of stabilizers	37
10. Ratings of spread-type dairy product as affected by use of synthetic flavor ingredient	39
11. Current patterns of use for butter, margarine, and mayonnaise by 50 Brookings families	41
12. Substitution of new product by 50 Brookings families.	42
13. Size of family and suitability of 8 oz. package size to 50 Brookings families	43
14. Price that would be paid for new product compared with competing products.	44

26618

LIST OF TABLES (Continued)

Table	Page
15. Age of family members in 50 Brookings families surveyed	45
16. Household income of 50 Brookings families surveyed	46
17. Rating for specific uses of spread-type dairy product, as made by 50 Brookings families	47

Increasing interest in profitable means of utilization of dairy products. Studies of their nutritive and high nutritive value, the most logical manner of disposition of dairy products is, from the standpoint of the general welfare, in human food; generally this is also the most profitable method. The high nutritional value of these products also makes them valuable in feeding calves, pigs, and poultry. This use has been justified to a great extent by the relatively high cost of other protein feeds. However, the increasing tendency has been for dairy farmers to sell whole milk rather than cream to increase their income and the second hand demand for whole milk has increased from 1914 to 1924. This situation and the possibility of future increasingly large surpluses of milk have caused the manufacturers of dairy products to consider more seriously than ever before the manufacture and sale of new products which may be made from milk products and surplus.

The investigation reported herein concerned general information on the feasibility of a new spread-type dairy

INTRODUCTION

For many years the dairy industry has been going through transitional periods whereby many marketing and structural changes have resulted. Generally speaking, these changes have been advantageous to the dairy farmer.

During the past years there has been a widespread and increasing interest in profitable means of utilization of dairy by-products. Because of their unique and high nutritional value, the most logical method of disposition of these by-products is, from the standpoint of the general welfare, in human food; generally this is also the most gainful method. The high nutritional value of these products also makes them valuable in feeding calves, pigs, and poultry. This use has been justified to a great extent by the relatively high cost of other protein feeds. However, the increasing tendency has been for dairy farmers to sell whole milk rather than cream to increase their income and to use greater quantities of protein feeds not derived from milk. This situation and the possibility of future increasingly large surpluses of milk have caused the manufacturers of dairy products to consider more seriously than ever before the manufacture and sale of new products which may be made from milk by-products and surpluses.

The investigation reported herein concerned general information on the feasibility of a new spread-type dairy

product, background on consumer acceptance trials, and a specific consumer evaluation test on the new spread-type dairy product. It was part of a cooperative research project between the Dairy Science Department of South Dakota State University, the American Dairy Association, and the United States Department of Agriculture.

OBJECTIVES

The primary objective of this research was to assess the potential consumer acceptance of a low-fat dairy spread and to appraise the extent to which this product might assist in expanding the market for dairy products. A secondary objective was to provide processors and others with facts concerning the consumer evaluation for the new product and various attributes thereof to enable them to make production and marketing decisions.

PROCEDURE

This study of consumer acceptance for a low-fat dairy spread was divided into two phases. The participants in both phases of the study consisted of 50 families in Brookings, South Dakota. The telephone directory was used as a source in selecting the participants. Every sixteenth name was selected after random selection of the first name had been made. Business listings were eliminated before the names were selected.

The first phase of the research was a nine week project involving the use of many different formulas and variations of the product. Each week, three samples of the product were delivered to the 50 families participating. One sample was a control of a relatively constant formula from week to week and the other two samples contained modifications of kind and quantities of ingredients of the basic formula. The families were asked to score the samples, rank them, and give comments as to likes and dislikes for each particular sample. A sample score sheet is shown in the Appendix. A new score sheet was delivered with each group of samples and the results of the previous week were collected as a new group of samples were delivered. An explanatory letter was included each week as part of the score sheet page.

The samples were scored for flavor, smoothness, and spreadability in the following manner:

- | | |
|-------------------|------------|
| a. Excellent | - 1 point |
| b. Very good | - 2 points |
| c. Good | - 3 points |
| d. Average | - 4 points |
| e. Fair | - 5 points |
| f. Poor | - 6 points |
| g. Not acceptable | - 7 points |

A low preference score indicated that the sample was highly preferred as 1 was the highest preference score that could be given. Each week the score sheets were totaled and analysis of variance comparing treatments was

determined on an electronic computer. From the score sheets and comments, direction was gained so that a composite formula was derived, consisting of the preferred attributes of the various formulas used during the nine week study.

The second phase of the research consisted of a detailed questionnaire type survey. The questionnaire was delivered to each family and completed by a personal interview. The questions asked involved such considerations as the use of the product, use of competing products, packaging, price factors, and income level of the household. The results of this phase presented an over-all view which the consumers gave to the new product. Information was gained concerning the size of package for the product, price which the consumer would be willing to pay for the product, and some idea concerning the effect this product may have on the over-all market for dairy products.

collaborated in the work of research. He learned by experience that research gave a pleasing aroma and fine flavor to his food. Research changes in eating habits were about when healthful and planned cereals, bread, meats, irrigated fertile land, and began settling in villages (2). As food became more abundant, flavor distinctions and food preferences developed rapidly.

In the last 50 years the area of food science has grown tremendously. Food science deals with a multitude of

REVIEW OF LITERATURE

History of Food Evaluation

It is appropriate when considering food evaluation to look at the early history of food development and see how man first became acquainted with different types and variations of food. It is known that the most primitive animals develop likes and dislikes for food, with many species displaying well known preferences for one food over another (2). However, it is not fully realized how often the senses of taste and smell have influenced the history of human behavior in preference for food. Although prehistoric man had little opportunity to make fine quality distinctions, he obviously rejected certain foods entirely and consumed others only in times of dire hunger. According to Amerine, Pangborn, and Roessler (2), the idea of improving flavor of food probably did not occur to early man until he accidentally discovered the art of roasting. He learned by experience that roasting gave a pleasing aroma and fine flavor to his food. Further changes in eating habits came about when Neolithic man planted cereals, tamed animals, irrigated fertile land, and began settling in villages (2). As food became more abundant, flavor distinctions and food preferences developed rapidly.

In the last 50 years the area of food science has grown tremendously. Food science deals with a multitude of

problems involved in providing food for human consumption. It includes the entire process from planting to serving. Investigations on the problems of food science involve biochemistry, microbiology, genetics, and other basic sciences, as well as engineering, horticulture, and other applied sciences (2). The research emphasis in the food industry has been primarily on means for economical preparation and distribution of bacteriologically safe and nutritious foods. Universities and experiment stations throughout the world have concerned themselves mainly with studies on chemical and nutritive composition, microbiological control, processing, and the functional properties of foodstuffs (2). World War II focused attention upon another aspect of food science: the organoleptic acceptance of food. It was found that foods were sometimes rejected by the potential consumer no matter how sound and nutritious they were (2). This led food science into the sensory analysis of food. Modern technology has changed the traditional methods of food preparation. This, as well as new and cheaper methods of production, storage, and distribution frequently altered the sensory appeal of food.

Over the years, the food industry has been involved in many attempts at developing and evaluating new foods and new methods of preparation of food (11). There have been many successes and, of course, some failures. Recently,

the Dairy Science Department at South Dakota State University has become involved in this area of development of a new food product. The particular product is a low-fat, spread-type dairy product.

Previous Work on Low-Fat Spread Product

A low-fat dairy spread may be described as a product which contains only dairy ingredients and, as the name implies, contains less fat than the commonly used spreads, butter and margarine (26).

The existence of legal barriers and, in some cases, industry prejudice, has barred such a product from the market. The Federal interpretation is that any dairy spread containing less than 80 percent milk fat would have to be labeled as adulterated butter and would be subject to a special tax by the Bureau of Internal Revenue (21).

Although this has prevented the commercial manufacture and sale of a low-fat spread, it has not stopped all research in this area. Researchers realize that man-made laws are subject to change. Laws and regulations can be revised when their existence is no longer necessary (21). However, the elimination of such laws sometimes becomes difficult because of the political power of organized minorities.

Any time a new product is being developed, the first questions raised are: "What is the need for the product?

What role will it play in the diet of the consumer?"

Research on a low-fat spread was accelerated during World War II because of the fat shortages at that time (25). It was thought that low-fat spreads could be used as a means to extend the available supply of fat. Today there are other reasons which may account for renewed interest in such a product. There is a current dietary trend away from high-fat foods with more emphasis being placed on lower calorie, high protein foods. Also, there appears to be a demand for a spread with improved spreadability and produced at a price which is more competitive with substitutes than butter is at the present time (7). An ideal spread product would be one which would have the satisfactory flavor of butter but would have better spreadability; the fat content would be low; and the price would be competitive with margarine or other spreads (7).

One of the primary reasons for developing an economical, low-fat dairy spread lies in the fact that the per capita consumption of butter in the U. S. has dropped significantly in recent years. Between 1930 and 1964, the proportion of milk used as butter declined from 45 percent to 26 percent of the total utilization (3). The per capita consumption of butter, which has been the biggest loser in the public's shift away from milk fat, dropped again in 1965. Per capita consumption in 1965 declined to 6.5

pounds per person compared to 6.8 pounds in 1964 (8). This is 61 percent of the consumption level during the 1947 - 49 base period when consumption averaged 10.6 pounds per person (8). It is about a third of our maximum per capita consumption of 18 pounds which occurred during the period 1925 - 29. The downward trend of butter consumption has resulted in heavy accumulations of milk fat by the dairy industry (22). This trend is expected to continue in the future. Kallemeyn (13), in 1963, projected that butter consumption in 1975 would be 3.43 pounds per person. These figures give reason to believe that new uses must be found for milk fat in products such as a new dairy spread.

Many attempts have been made to prepare spreads for bread which would be adequate substitutes for butter (27). None of these have been good enough to remain continuously on the market or to achieve a large sales volume. By-product spreads have been made by concentrating skimmilk, buttermilk, and whey to a paste or gel state (27). According to Whittier and Webb (27), substantial quantities of milk fat have been used in some spreads. One such product by Wilster (28) is described as being prepared by concentrating skimmilk and cream, adding 20 percent by weight of cultured buttermilk, 1.3 percent salt, and 25 grams of lactic acid per 25 pounds of total mixture. Starter distillate and vitamin concentrates were added after

pasteurization, and the mix was homogenized at sufficient pressure to thicken it slightly. It was filled into containers hot, and then cooled. The product contained 56 percent moisture, 26 percent milk fat, 15 percent milk solids not fat, 1 percent salt, and a high vitamin A and D content.

Whittier and Webb also report that a blend of concentrated whole milk, cream, salt, vegetable gum, acetic acid, and artificial flavor and color was produced and sold during World War II as a bread spread (24). It was slightly acid and had a mild milk flavor.

Grelck (12) worked on a semi-solid sour spread by coagulating the protein of whole milk, skimmilk, or buttermilk by acid produced by a lactic starter and by heating the mix to boiling. The fermented, coagulated milk was concentrated under vacuum to various degrees up to about 60 percent solids. The resulting gel could be flavored in various ways, such as by the addition of cured cheese.

Parsons (16) prepared a food product suitable for use as a spread, sandwich filling, or salad dressing, when mixed with cheese, fats, or condiments. A highly concentrated skim or whole milk was heated with stirring until the mixture became brown and attained a roast beef odor. Emulsifying salts were used to make a smooth mixture which could be blended with other foods.

on the market by Madison, Wisconsin dairies in October.

One of the first concentrated efforts to produce a low-fat dairy spread was conducted by K. G. Weckel of the Department of Dairy and Food Industries at the University of Wisconsin (24). Dr. Weckel first became interested in a product such as this during the World War II years when fats were in short supply. At that time the composition of such a spread was restricted to 28 percent fat by the War Food Orders (24). Dr. Weckel attempted to secure a patent for the production of a low-fat spread but was not successful. Work at Wisconsin has continued on a small scale in recent years. The ingredients used in their product consisted of: (25)

1. Fat and solids-not-fat derived from any dairy product source such as butter, cream, powdered cream, condensed skim milk, or low heat skim milk powder.
2. Cultured buttermilk.
3. Lactic acid, diacetyl (starter distillate), and salt.

Weckel (26) stated that the inclusion of cultured buttermilk provides a desirable flavor and texture in the spread. The presence of lactic acid induces coalescence of the fat upon homogenization and the development of a set or gel structure upon cooling. This product was first placed on the market by Madison, Wisconsin dairies in October,

1943. It was sold under the name Dyne (23). However, the product was removed from the market after a short time as government officials ruled that its manufacture would place a drain on the low supply of butterfat.

Some work has also been done at the University of Illinois by Tobias and Tracy (21). Their product had a 40 percent fat content and 8 percent solids-not-fat. They carried out some work on a consumer acceptance study for this product and reported that the acceptance was generally quite favorable. Tobias and Tracy further stated that the most popular use for this product was as an ingredient in sandwich fillings. The most objectionable aspect of their product was the flavor. Many suggested the addition of other flavors such as honey, maple, raspberry, or pineapple.

Other work on this type of product has been conducted at the University of Ontario by D. H. Bullock (5). In his product, he used butter and butter-oil as the sources of fat. The fat was added after the other ingredients were pasteurized. Butter color was added and the product was packaged in 1 lb. containers. A limited consumer evaluation test was carried out. The product was reported to be well accepted.

S. W. Seas originated the work at South Dakota State University on a low-fat dairy spread. Later, Dr. K. R. Spurgeon became project leader of the study. The early

work at South Dakota was designed to develop a dairy product containing 30 to 50 percent milk fat and 15 to 20 percent nonfat milk solids, which could be used as a spread or for other purposes in cookery and food serving, such as shortening or seasoning (K. R. Spurgeon, personal communication). Different combinations of dairy ingredients and stabilizers were tried in the search for the best possible formulation. In addition to trials on composition, methods of processing were varied in attempts to discover the best method for preparing the product. A small churn was used initially; however, it did not blend the constituents to the optimum homogeneous state. Therefore, the approach of Weckel (25) was used, whereby the ingredients were blended while stirring and heating then pasteurized and homogenized.

Introduction of New Foods and Consumer Acceptance Trials

The number of problems that demand consideration in the introduction of new food products is large. After the initial idea has been conceived; the laboratory and pilot plant studies made; and the decision has been reached to proceed with the development of the idea; there arise problems of packaging and package size, labeling, the determination of selling price, creation of basic advertising themes, coordination of production, details of market tests and review of results, and final marketing plans (4). It was with these problems in view that the work at South

Dakota turned in 1965 toward the area of consumer preferences and consumer acceptance for this type of spread product. *Field of consumer testing is not an exact science.*

The future of any new food product rests primarily on acceptance by the consuming public. Whether consumers will purchase a product at a rate commensurate with the supply and at a price high enough to ensure a continuous flow of the product into the market is of constant concern to the producer (2). The use of consumer acceptance studies will continue to grow as competition for the consumer food dollar increases. The competitive aspects are readily visualized when it is considered that the daily per capita caloric intake remains relatively constant in this country, so that a new food product succeeds to the extent that it replaces another food item or benefits by population increase (2). *Stores? Are the necessary vitamins and amino-*

The acceleration of new-product development emphasizes the need for reliable, efficient, and representative sampling of consumer opinion as well as continuous study of changes in food habits (19). The influence and magnitude of consumer opinion is recognized by such large consuming groups as the United States Army, which supports a very active food acceptance program (29). General Foods Corporation, the Kroger Foundation, and other private industries *appearances in food selection, the U. S. Testing Company (9)*

also rely heavily on information obtained from consumer surveys (2).

The field of consumer testing is not an exact science. If the job were chemical in nature, it could be run in a laboratory and the results could be reported precisely (19). However, live samples are used and preferences vary from person to person. Also, each homemaker has different problems facing her as she goes shopping. She has to determine the amount of money she can spend, the best food buys, the taste preferences of her family, and at the same time consider the proper diet for the good health of her family. The modern day homemaker-consumer reads the labels on the cans for information and is always asking herself, "Which brand shall I select? Which product gives me the best return for my money? How long have the foods been on the shelves or in storage? Are the necessary vitamin and mineral levels maintained?" (19).

Many complex factors combine to influence the public's acceptance and selection of food; these are indicated in Table 1, page 16, taken from Amerine et al. (2).

Appearance of food probably has the greatest initial influence, since visual properties significantly control selection of the item from the hundreds of choices on the grocer's shelves (2). To test the importance of color and appearance in food selection, the U. S. Testing Company (9)

asked a large group of shoppers to wear specially tinted goggles while doing their normal food buying. When the glasses were removed prior to the checkout counter, every shopper was surprised at her selection of meats, cheese, fruits, vegetables, and even of strange brands. The experiment showed that removal of color discrimination slowed the shopper and altered her food selections.

TABLE 1

Factors which influence selection and acceptance of food

Attributes of the food product	Attributes of the consumer
1. Availability	1. Regional preferences
2. Utility	2. Nationality, race
3. Convenience	3. Age and sex
4. Price	4. Religion
5. Uniformity and dependability	5. Education, socio-economics
6. Stability, storage requirements	6. Psychological motivation
7. Safety and nutritional value	a. Symbolism of food
	b. Advertising
8. Sensory properties	7. Physiological motivation
a. Aroma and taste	a. Thirst
b. Appearance	b. Hunger
c. Texture, consistency	c. Deficiencies
d. Temperature	

Once the food has been tasted, color and texture quite often become secondary to flavor. Flavor has been mentioned by an overwhelming proportion of consumers as the reason for over-all preference and continued use of a product (10).

Price is also an important limitation of the freedom with which the consumer selects foods (2). Pangborn and Leonard (15) conducted a study of consumer buying behavior for canned pears and reported that 68 percent of 179 families said the selection of a specific brand was made on the basis of flavor whereas 59 percent of 128 families who purchased eight minor brands did so because of lower price. The factor of price becomes especially significant as the price margin between two competing products widens. This is shown clearly when butter and margarine are considered. As stated previously, the per capita consumption of butter has fallen from 10.6 pounds in 1947 to 6.8 pounds in 1964; while the per capita consumption of margarine has increased from 5 pounds in 1947 to 9.7 pounds in 1964 (8). This is largely explained by the substantially lower price of margarine. In a study by Shaffer and Quackenbush (20), it was reported that most families preferred butter to margarine; however, 80 percent of the 56 families said the reason they used margarine was because it was cheaper. Rollog and Kristjanson (18) attempted through a survey to answer the

question, "Why has the use of butter been declining while the use of margarine has been steadily increasing?" The survey involved 322 families in Sioux Falls and 50 families in Brookings, South Dakota. It was reported that families preferred butter but price was an important reason for using margarine rather than butter.

In pilot testing of any new product, the emphasis should be on the inherent properties of the product--aroma, flavor, texture, shape, color, and consistency. As stated by Amerine et al. (2), there is no effect of marketing factors such as brand, label, price, packaging, distribution, or advertising. One important use of pilot testing in the food industry is to provide an estimate of the relative importance of flavor of the product in comparison with other properties such as convenience, storage quality, or brand distinction. According to Amerine et al. (2), the consumer may be given only enough of the sample for a single use -- the single exposure method. This method could be used when time and money are limited, when the amount of the product is limited, or when only an estimate of consumer preference is desired. The authors also stated that pilot testing to determine consumer acceptance after prolonged use of the product is usually done in the home. This of course, is more time consuming and more expensive, but a better idea of consumer reaction is obtained, as the

product is used in normal consumption.

One of the most important items of any consumer preference study is the selection of a representative sample. As stated by Amerine et al. (2), there are many possible methods of selecting a sample from a population. The particular method chosen may depend on the judgement of the people who claim to know the population; it may be defined as that part of the population which is most conveniently available; or it may be a random sample based on the theory of probability. Another type of sample selection which can be used is systematic sampling, in which the design calls for selection from the population of every Rth element or the use of some other specified pattern (2). An example of this type is sampling by the selection of every 10th name from the telephone directory. This, of course, samples only the population with listed telephone numbers. The simplest and least expensive method that will fulfill the requirements of the survey should be used in selecting the sample.

There are various methods of approach to consumer studies. In some cases, information can be obtained merely by careful observation of food habits and food selection. Product samples can be given free and the consumer can be asked to state his preference. Carefully worded questionnaires are frequently used to obtain consumer reaction

concerning selection and use of commodities. The effectiveness of this method depends on the questionnaire and the degree of cooperative spirit received from the consumer, as well as the type of approach employed. With the questionnaire method the four most common approaches are: telephone, mail, personal interview, and public test (2).

The telephone approach is quite economical provided there are no long distance calls involved. However, decisions made on the telephone may lack sufficient thought and questions can be easily misinterpreted. Also, the people who do not have a telephone are automatically eliminated from the sample.

Approach by mail has apparently been the most popular in handling questionnaires. Kramer and Shaffer (14), in 1954, stated that over the past ten years approximately 90 percent of all the revenue received for market research by commercial research firms has been from studies conducted by mail. The Marketing Research Committee of the American Marketing Association (1) reports the major advantages and disadvantages of the mail survey method to be as follows:

Advantages:

1. A low per unit cost (as compared with a similar personal interview).
2. A wide geographic distribution of respondents is possible.

3. It is useful in reaching specific classes of people (executives, retailers, home owners, etc.).
4. There can be no interviewer bias.
5. No identification of respondents is necessary; hence it is possible to obtain more honest replies than with the short answer type of personal interview.

Disadvantages:

1. It is impossible to know whether the intended person answered and whether or not he consulted others.
2. It is difficult to obtain detailed qualitative answers or to know precisely what the offered responses mean.
3. The questionnaire must be short.
4. It is difficult to obtain a really representative list of the universe required.
5. Those who reply are probably not typical members of the list (those especially interested, or those particularly in opposition to the ideas presented have been shown to be most likely to reply).

The personal interview approach is quite often the only reliable way of obtaining information on food preferences (2). However it introduces a possible bias of the interviewer. A good interviewer is alert, friendly, patient, does not argue or give advice and does not influence the consumer's response. It is not uncommon to combine mailing techniques and personal interviews in the same study.

The public test approach can take place at any public meeting place, such as in a grocery store or at a county

fair, or it can be carried out in the home. An example of this type of testing is the consumer wine analysis conducted at the University of California (2). Two hundred and two families were used to determine the effect of repeated tasting, over a relatively short period, on degree of liking of experimentally prepared wine samples. Coleman (6) stated that this type of consumer testing has been utilized successfully by General Foods Corporation.

Once the survey or test is completed, the results must be analyzed. Analysis may involve a detailed statistical review or in some cases it may consist merely of totaling the compiled data. It has been only in the last 15 years that experimental designs have been extensively used in the evaluation of foods and beverages (2). The analysis should show a picture of the results of any survey or consumer study. There is a certain amount of risk, however, in applying results from consumer surveys. This risk is increased somewhat by the time lapse between the survey and the actual marketing of the product.

Pettersen (17) has extended advice to food processors by writing the following guidelines:

1. Don't change a product until it has been product-tested, and actively promoted.
2. Build a different feature into the product which can be promoted.

3. Pioneer new fields rather than imitate a successful leader.
4. Enter markets that are growing.
5. Seek rapid acceptance through products featuring convenience in preparation, performance, or packaging.
6. Design a reliable test program of ample sample size, adequate cross section, with proper collection and interpretation of the data.

Color Variations

During the first week, the variable tested was color. Samples of three lots, (lot nos. 254, 255, 256) with variation in color, were delivered to the 50 families. Lot no. 254 contained no added coloring material. Lot no. 255 contained 15 g of annatto butter coloring and 400 mg of Roche 15 percent beta Carotene Beadlets. (Roche 15 percent beta Carotene Beadlets are dark, red particles consisting of a colloidal dispersion of beta carotene in a matrix of gelatin, vegetable oil, sugar and carbohydrate. This product is used to give yellow to orange color in dairy products and many other foods where a rich, natural-appearing

EXPERIMENTAL

First Phase

The first phase of the study was designed to obtain the preferences of the consumer and arrive at a composite formula for the new product. This phase covered a period of nine weeks in which three samples were delivered to each of the families each week. During the course of the nine week study, the experimental lots were numbered consecutively from number 254 through number 281. The only exception was lot no. 267, which was not delivered to the families due to a laboratory error in the formulation of that particular lot.

Color variations

During the first week, the variable tested was color. Samples of three lots, (lot nos. 254, 255, 256) with variation in color, were delivered to the 50 families. Lot no. 254 contained no added coloring material. Lot no. 255 contained 32 ml of annatto butter coloring and 400 mg of Roche 15 percent Beta Carotene Beadlets. (Roche 15 percent Beta Carotene Beadlets are dark, red particles consisting of a colloidal dispersion of beta carotene in a matrix of gelatin, vegetable oil, sugar and carbohydrate. This product is used to give yellow to orange color in dairy products and many other foods where a rich, natural-appearing

yellow to orange color is desired.) Lot no. 256 contained 64 ml of annatto butter coloring and 800 mg of Roche 15 percent Beta Carotene Beadlets. Each of the above lots contained 58 pounds of total product.

The samples were scored solely on the basis of color preference during the first week, as all ingredients were the same with the exception of coloring material. The color rating scores are shown in Table 2.

TABLE 2
Ratings of spread-type dairy product as affected by color variation

Lot no.	Totals of ratings by 50 Brookings families
254 (no added color)	252
255 (medium level color)	125
256 (high level color)	153

Note - lowest score indicates highest preference

Keeping in mind that the lowest score indicates the highest preference, it was quite obvious that the medium level of color variation was preferred by the 50 families. An analysis of variance was run on the total scores of each lot. The preference for no. 255 was found to be highly significant when the score was compared with scores

for lot nos. 254 and 256. This seemed to indicate that people prefer table spreads to be colored in semblance of summer butter.

Variations in kind of whey powder

In the second week of the study, various levels of Cheddar cheese whey powder and Cottage cheese whey powder were used in the formula. The Cheddar cheese whey powder used in the study was a Kraft type whey powder and was obtained from Valley Queen Cheese Factory Inc. in Milbank, South Dakota. The Cottage cheese whey powder was obtained from Kraft Foods Company of Chicago, Illinois. The brand name of the Cottage cheese whey powder was Sealac spray dried cottage cheese whey solids, which is sometimes referred to as Acid Whey. It was hoped that the use of this product would reduce sweetness and add an additional tartness of flavor.

Lot no. 257 contained 4 pounds of Cheddar cheese whey powder and no Cottage cheese whey powder. Lot no. 258 contained 3 pounds of Cheddar cheese whey powder and 1 pound of Cottage cheese whey powder. Lot no. 259 contained 2 pounds of Cheddar cheese whey powder and 2 pounds of Cottage cheese whey powder. Each of the above lots contained 58 pounds of total product.

Beginning this week, the participants were asked to score the product on the basis of flavor, smoothness, and spreadability. The rating scores are shown in Table 3.

TABLE 3

Ratings of spread-type dairy product as affected by the use of Cheddar and Cottage cheese whey powder

Lot no.	Flavor	Totals of ratings by 50 Brookings families		
		Smooth- ness	Spread- ability	Total
257 (Cheddar whey)	141	139	136	416
258 (3 parts Cheddar whey - 1 part Cottage whey)	160	135	131	426
259 (2 parts Cheddar whey - 2 parts Cottage whey)	142	146	123	411

Note - lowest score indicates highest preference

There was very little difference in the total rating scores of the three samples. When the rating scores were analyzed statistically, no significant differences were found in the scores for the respective attributes. Apparently the variations between lots were not as wide as they should have been. The participants found it difficult to differentiate between the three lots.

Variations in salt levels

During the third week, various levels of salt were used as the only variable in the formula. Lot no. 260 contained 140 g of added salt which was calculated to be 0.5 percent. Lot no. 261 contained 220 g of added salt which was calculated to be 0.8 percent. Lot no. 262 contained 300 g of added salt which was calculated to be 1.1 percent. Each of the above lots contained 58 pounds of total product. The rating scores for the third week are shown in Table 4.

TABLE 4

Ratings of spread-type dairy product as affected by variations in salt level

Lot no.	Level added salt	Flavor	Totals of ratings by 50 Brookings families		
			Smooth- ness	Spread- ability	Total
260	0.5%	152	131	139	432
261	0.8%	153	130	140	423
262	1.1%	109	127	150	386

Note - lowest score indicates highest preference

Lot no. 262, with the highest level of added salt, was distinctly preferred over the other lots on the basis of flavor. The participants were quite consistent in their preference for the high salt level. When analyzed

statistically, this preference was found to be highly significant. Ratings for the other factors of smoothness, spreadability, and total score were not significantly different. In the following weeks, the high level of salt was used in all the lots.

Variations in type of culture used

During the fourth week of the study, various types of culture were used. Lot no. 263 contained 5600 ml of H-5 culture in 58 pounds of total product. H-5 culture was a mixed species (Streptococcus and Leuconostocs) culture which was inoculated at the rate of 1 percent. It was transferred daily into whole milk, which previously had been steamed for 45 minutes, and grown at 21°C for 18 hours prior to use.

Lot no. 265 contained 5600 ml of KF culture in 58 pounds of total product. KF was a pure culture of Leuconostoc citrovorum. It was inoculated at the rate of 2 percent and was grown in sterilized reconstituted NFDM at 21°C for 18 hours. It then was acidified with 15 percent citric acid and allowed to set 18 hours before use to allow time for formation of diacetyl.

Lot no. 264 contained a combination of the two cultures (2800 ml H-5 and 2800 ml KF).

The rating scores for the fourth week are shown in Table 5.

TABLE 5

Ratings of spread-type dairy product as affected by the use of different cultures

Lot no.	Flavor	Totals of ratings by 50 Brookings families		
		Smooth- ness	Spread- ability	Total
263 (H-5 culture)	145	135	143	423
264 (H-5 & KF culture)	138	119	124	381
265 (KF culture)	150	151	157	458

Note - lowest score indicates highest preference

On the basis of flavor ratings, there were no significant differences in the samples. There were, however, highly significant differences in the scores concerning smoothness and significant differences concerning spreadability and total score, with lot no. 264 being preferred in all instances. The reason for these differences was possibly because the KF culture was acidified with citric acid which could account for differences in body and texture.

The most interesting aspect of this particular week was that there were no significant differences in flavor

scores. Lot no. 265, with KF culture, had a more acid flavor than lot no. 263 which contained H-5 culture. Apparently some of the participants in the study preferred the high acid flavor while others preferred a more bland product. As a result, there were no significant differences in flavor ratings. Because of this fact and the ease and simplicity of preparation H-5 culture, as compared to KF culture, the H-5 culture was used in succeeding weeks of the study. It was felt that the factors of smoothness and spreadability could be improved by stabilizer effect, homogenization pressure, pasteurization temperature, and general handling and storage procedures.

Lots with and without commercial starter distillate

In the fifth week of the study, only two lots were used. One contained no commercial starter distillate; whereas the other lot contained a relatively high level of this flavor-giving product. Lot no. 266 contained 4700 ml of H-5 culture with no starter distillate. Lot no. 268 contained 4700 ml of H-5 culture with 200 ml of starter distillate, which was calculated to be 0.8 percent of total product. (Butter which is made with starter distillate normally contains 0.2 to 0.3 percent starter distillate.)

The rating scores for the fifth week are shown in Table 6.

TABLE 6

Ratings of spread-type dairy product as affected by starter distillate

Lot no.	Flavor	Totals of ratings by 50 Brookings families		
		Smooth- ness	Spread- ability	Total
266 (no starter distillate)	118	116	116	350
268 (high level starter distillate)	144	142	143	429

Note - lowest score indicates highest preference

Lot no. 266 was preferred in all aspects. The scores were significantly different on the basis of flavor and highly significant on the basis of smoothness, spreadability, and total score. From the comments received, it was interpreted that lot no. 266 was not highly acceptable, but it was more acceptable than lot no. 268. Some of the families reported that lot no. 266 was too bland, while lot no. 268 was too harsh in flavor. As a result, a decision was made to use starter distillate in the formula but at an intermediate level. It had been intended to include an

intermediate level in this week's samples, however a laboratory error precluded this possibility.

Variations in stabilizer levels

The sixth week of the study involved the use of various levels of C.M.C. and gelatin stabilizers. C.M.C. is the trade name for sodium carboxymethylcellulose. It has a high water-holding capacity; it is quite soluble; and it acts also as an emulsifier. Gelatin was one of the first commercial stabilizers and still is used today. Its advantage lies in its ability to form a gel in the product. It also contributes to the smoothness in texture and firmness in body of the finished product.

Lot no. 269 contained 10 g C.M.C. and 10 g gelatin. Lot no. 270 contained 20 g C.M.C. and 20 g gelatin. Lot no. 271 contained 30 g C.M.C. and 30 g gelatin. The above lots each contained 50 pounds of total product. The rating scores are shown in Table 7, page 34.

The rating scores were quite close in all aspects. They were particularly close on the basis of flavor. This was to be expected as the level of stabilizer does not ordinarily affect flavor. Lot no. 270 had a weak body and did not spread as well as the other two samples, according to the comments of the participants. However, when analyzed statistically, no significant differences were found

in the rating scores concerning flavor, smoothness, spreadability, or total score.

TABLE 7

Ratings of spread-type dairy product as affected by variation in stabilizer level

Lot no.	Stabilizer	Totals of ratings by 50 Brookings families			
		Flavor	Smoothness	Spreadability	Total
269	10 g C.M.C. 10 g gelatin	127	112	116	355
270	20 g C.M.C. 20 g gelatin	124	127	133	384
271	30 g C.M.C. 30 g gelatin	125	106	113	344

Note - lowest score indicates highest preference

Use of milk protein preparations

During the seventh week of the study, two types of milk protein concentrates were used in partial substitution for Cheddar cheese whey powder in an effort to reduce the lactose content of the product and hence reduce the sweetness. The milk protein concentrates used in the study were obtained from Crest Foods Company Inc., Ashton, Illinois. This company has a process whereby all the milk proteins are co-precipitated simultaneously. They then prepare commercial blends of the proteins and other milk constituents.

One type of protein concentrate used was called Crest 8S, which is an 85 percent protein material with 3 percent lactose. It has a high water holding capacity and tends to improve storage stability. (Personal communication with Morrison Loewenstein, Ph.D., Research Manager, Crest Foods Company, Inc.)

The second type of protein used was Crest 6S, which is a 50 percent protein concentrate with 35 percent lactose. It is completely soluble, and is used frequently to fortify skim milk, low fat milk, and other fluid dairy products. (Personal communication with Morrison Loewenstein, Ph.D., Research Manager, Crest Foods Company, Inc.)

Lot no. 272 was the control sample which contained 3 7/8 pounds of Cheddar cheese whey powder with no Crest protein. Lot no. 273 contained 7/8 pound Cheddar cheese whey powder and 3 pounds Crest 6S protein concentrate. Lot no. 274 contained 7/8 pound Cheddar cheese whey powder and 3 pounds Crest 8S protein concentrate. The above lots each contained 58 pounds of total product.

The rating scores for the seventh week are shown in Table 8, page 36.

Lot no. 272, which was the control lot with no added protein concentrate, was preferred in all aspects with the widest difference of scores being in the area of smoothness and spreadability. Most of the participants indicated that

lot nos. 273 and 274 were coarse in texture and had poor spreading quality. When analyzed statistically, the scores for lot no. 272 were highly significant in difference on the basis of flavor, smoothness, spreadability, and total score.

TABLE 8

Ratings of spread-type dairy product as affected by use of added milk protein concentrate

Lot no.	Protein added	Totals of ratings by 50 Brookings families			
		Flavor	Smoothness	Spreadability	Total
272	None	121	106	102	329
273	Crest 6S	134	143	170	447
274	Crest 8S	169	204	210	583

Note - lowest score indicates highest preference

Use of various kinds of stabilizers

During the eighth week two different types of stabilizers were used in substitution for the blend of C.M.C. and gelatin stabilizers which was used in the control sample. Lot no. 275 was the control lot and contained C.M.C. and gelatin as the stabilizers. Lot no. 276 contained Freezist #16 starch, which was a modified potato starch and was recommended for high acid and high heat products.

Lot no. 277 contained Polar Gel cornstarch as the stabilizer material. This was a starch extracted from corn and was recommended for products which are subjected to high heat. The rating scores are shown in Table 9.

TABLE 9

Ratings of spread-type dairy product as affected by various types of stabilizers

Lot no.	Stabilizer	Totals of ratings by 50 Brookings families			
		Flavor	Smoothness	Spreadability	Total
275	C.M.C. + gelatin	115	118	133	366
276	Freezist #16 Starch	136	135	156	427
277	Polar Gel Cornstarch	132	138	155	425

Note - lowest score indicates highest preference

The rating scores were quite closely grouped this week. Lot no. 275, which was the control, appeared to have been slightly preferred in all aspects. However, when analyzed statistically, there were no significant differences in the rating scores. This apparently reflected differences in the personal preferences of the 50 families since there were marked differences in body characteristics. Lot no. 275 had a smoother texture and a slightly less firm body

than the other two lots. Lot nos. 276 and 277 were somewhat sticky and did not have as good spreading qualities as lot no. 275.

Use of synthetic flavor material

The area of flavor was experimented with during the ninth week of the study. Two levels of a synthetic flavor formulation plus lactic acid were used in addition to the control sample which contained starter distillate plus H-5 culture. The synthetic flavor formulation was a blend of ingredients which was developed by Day, Lindsay, and co-workers, at Oregon State University, to simulate the flavor characteristics of good butter-type bacterial cultures. (Personal communication with Dr. R. C. Lindsay, Oregon State University)

Lot no. 279 was the control lot which contained starter distillate and H-5 culture. Lot no. 280 contained $7\frac{1}{2}$ ml of the synthetic flavor material plus 50 ml lactic acid. Lot no. 281 contained $12\frac{1}{2}$ ml of the synthetic flavor material plus 50 ml lactic acid. Lot nos. 280 and 281 contained no starter distillate and no culture.

The rating scores for the ninth week are shown in Table 10, page 39.

There were very little differences in the rating scores on the basis of flavor. However, there were wide

differences on the basis of smoothness and spreadability, and total scores were highly significant in favoring lot no. 279.

TABLE 10

Ratings of spread-type dairy product as affected by use of synthetic flavor ingredient

Lot no.	Flavor	Totals of ratings by 50 Brookings families		
		Smooth- ness	Spread- ability	Total
279 (culture plus starter distillate)	106	91	89	286
280 (low level of synthetic flavor)	109	112	133	354
281 (high level of synthetic flavor)	120	123	156	399

Note - lowest score indicates highest preference

In this week of the study, it was discovered that the lots with the synthetic flavor ingredient were as well accepted, on the basis of flavor, as the lot with culture plus starter distillate. However, the synthetic flavor material apparently affected the smoothness and spreading qualities of the product. The participants reported that lot nos. 280 and 281 had very poor spreading qualities. Also, in general, they felt that these two lots did not

have the smoothness of body that lot no. 279 had. These facts indicated that further work had to be carried out to correct this condition if synthetic flavor materials were to be used.

Second Phase

The second phase of the study consisted of a questionnaire type survey which was designed to bring out the attitudes of the consumers concerning certain attributes of the product. These attributes included price, position of the product, and size and shape of package. The survey was carried out by personal interview. Interview completion rate was 100 percent.

Seventy-six percent of the families used the product mainly as a spread on bread, toast, rolls, or muffins. Eighteen percent used it mainly as an ingredient in cake icings, waffle batter, cookie batter, rolls, and general cooking. Six percent of the families used the product mainly as a sauce on cooked vegetables. Of the families who used it as a spread, 48 percent rated it EXCELLENT. The major reasons for the high rating appeared to be the smoothness and spreadability of the product.

The majority of the families participating used both butter and margarine in their homes. Table 11 shows the

patterns of use for butter, margarine, and mayonnaise by the 50 families surveyed.

TABLE 11

Current patterns of use for butter, margarine, and mayonnaise by 50 Brookings families

Frequency of use	Butter		Margarine		Mayonnaise	
	No.	%	No.	%	No.	%
Every day	30	60	21	42	4	8
Every other day	4	8	5	10	9	18
Once per wk	4	8	9	18	25	50
Twice per wk	3	6	9	18	8	16
Do not use each wk	2	4	3	6	2	4
Never use	7	14	3	6	2	4
Total	50	100	50	100	50	100

Table 11 shows that more of the families surveyed used butter every day than margarine. However, 7 families never used butter while only 3 families never used margarine. The major use for margarine was for cooking and baking while the major use for butter was as a table spread. It appeared that mayonnaise was not in strong competition with either butter or margarine. Mayonnaise was used mainly for salad dressing and as a sandwich base.

One question was asked to determine if the new product was substituted or used in addition to butter, mayonnaise, or margarine. Results are shown in Table 12.

TABLE 12

Substitution of new product by 50 Brookings families

Product normally used	New Product was:	
	Substituted	Used in Addition
Butter	34	15
Margarine	37	12
Mayonnaise	20	7

It was indicated here that the new product was substituted for butter and margarine in an approximately equal manner. These results also show that the new spread was not normally compared to mayonnaise. Only 27 families responded to the question concerning mayonnaise. It was generally felt that butter and margarine are used more closely in the manner in which the new spread would be used.

The product used in this study was packaged in 8 oz. containers. The respondents were asked if this quantity would be enough for one week if used regularly. Table 13, page 43, shows the suitability of the 8 oz. package size.

TABLE 13

Size of family and suitability of 8 oz. package size to 50 Brookings families

Size of family	No. of families	8 oz. package was:		
		more than one week supply	one week supply	less than one week supply
1 or 2 persons	17	2	10	5
3 to 4 persons	22	3	11	8
5 or more persons	11	0	4	7
TOTAL	50	5	25	20

Table 13 shows that as the size of family becomes larger, a larger size package would be needed for a week's supply of the product. As a general rule, the housewife completes the majority of her grocery shopping on a once per week basis. Therefore, a package size that approximates a week's supply would seem to be most appropriate. The 8 oz. package appeared to be approximately a week's supply for most families, as 30 of the 50 families replied to an attendant question that they would prefer an 8 oz. package. However, it should be mentioned that there may have been a certain amount of bias as the 8 oz. package was

the only size package supplied to the 50 families throughout the study.

Another area probed was that of price. The participants were asked to estimate what they would be willing to pay for this product in comparison to butter, margarine, and mayonnaise. For the purposes of this study butter was priced at \$0.70 per lb., margarine at \$0.45 per lb., and mayonnaise at \$0.40 per lb. The results are shown in Table 14.

TABLE 14

Price that would be paid for new product compared with competing products

Competing product	Price/lb	Estimated price that would be paid for new product
Butter	\$0.70	\$0.59
Margarine	\$0.45	\$0.52
Mayonnaise	\$0.40	\$0.46

The respondents were willing to pay more for the new product than either margarine or mayonnaise. However, they would not pay as much for it as they would pay for butter. The public apparently feels that butter contains a certain superiority over other spreads and even though the per capita consumption of butter has been dropping it is still

considered a superior product. This fact was brought out by some of the families who stated that they used butter only when they had company or for other special occasions.

The participants were asked what they would be willing to pay for the 8 oz. package of the new spread. The responses ranged from \$0.15 to \$0.50. The average price that 50 families would have been willing to pay for the 8 oz. package was \$0.29.

Some additional facts were obtained from the 50 families participating. Table 15 shows the age break-down of the families.

TABLE 15
Age of family members in 50 Brookings families surveyed

Age	Total No.	Ave. per family
0-13	44	0.88
14-20	30	0.60
21-39	49	1.00
40-59	34	0.68
60 & over	14	0.28

Age composition had no apparent effect on the preference for this product. Within some families, the children preferred it over other spreads and in other families the children did not particularly care for the product.

Information concerning the total household income is shown in Table 16.

TABLE 16
Household income of 50 Brookings families surveyed

Income	No. of families
0 - \$3,000	7
\$3,000 - \$6,000	24
\$6,000 - \$9,000	11
over \$9,000	8

As can be seen, a fairly representative sampling of various income levels was obtained. It appeared from the information obtained and is the opinion of this author that the product was more popular with families in the lower income levels.

The families were asked to give an over-all rating for each specific use of the product. The results are found in Table 17, page 47.

The product was rated quite high in all areas except for use as a sauce on vegetables. The main complaint when using the product as a sauce was that it left a filmy appearance on the vegetables and it did not melt easily.

This was remedied some by heating it slightly before placing it on the vegetables. The high rating when used as a spread and as a sandwich base was explained largely by the smoothness and the ease of spreading of the product.

TABLE 17

Rating for specific uses of the spread-type dairy product, as made by 50 Brookings families

Use	Excellent		Good		Fair		Poor	
	No.	%	No.	%	No.	%	No.	%
Spread	23	48	19	40	6	12	0	0
Sauce	10	24	13	32	11	27	7	17
Cooking	18	48	15	41	3	8	1	2
Sandwich Base	13	48	11	41	3	11	0	0

SUMMARY AND CONCLUSIONS

The first phase of the study involved the use of different formulas and variations of the product to obtain the preferences of the consumer and arrive at a composite formula consisting of the preferred attributes. From the results of the first phase, the following conclusions were drawn:

1. The consumers desired a medium level of color quite similar to the color of butter.
2. No significant differences in preference were found when comparing the use of Cheddar cheese whey powder with Cottage cheese whey powder at the levels employed in this study.
3. A relatively high level of salt was preferred, (1.25 percent added salt).
4. The use of KF culture did not result in a flavor preference over the product containing H-5 culture. H-5 culture was a mixed species of Streptococcus and Leuconostoc, while KF was a pure culture of Leuconostoc citrovorum.
5. When no starter distillate was used, the product was found to be too bland while the use of a high level of starter distillate resulted in a harsh

- flavor. Therefore, an intermediate level of starter distillate was used in the following weeks.
6. No significant differences were found when comparing 10 g, 20 g, and 30 g levels of C. M. C. and gelatin as stabilizers.
 7. The use of milk protein concentrates in lieu of Cheddar cheese whey powder did not increase the preference for the product.
 8. No significant differences in preference were found when comparing different types of stabilizers (C. M. C. + gelatin, Freezist #16 Potato Starch, and Polar Gel Cornstarch). This apparently reflected differences in the individual preferences of the participants, as the use of Freezist #16 Potato Starch and Polar Gel Cornstarch resulted in a product with a somewhat weak body.
 9. Spread containing a synthetic flavor formulation, which was designed to simulate the flavor characteristics of butter-type bacterial cultures, was found to be acceptable on the basis of flavor. However, the synthetic flavor material adversely affected the body and texture of the product.

The second phase of the study involved a questionnaire type survey. The survey brought out the following facts:

1. The majority of families used this product mainly as a spread on bread, toast, rolls, or muffins.

The major attributes of the product which were liked by the 50 families were the smoothness of body and the extremely good spreading quality.

2. The new product was substituted for butter and margarine in an almost equal manner. Thirty-four of the 50 families reported that they substituted the new product for butter, while 37 of 50 families said they substituted the new product for margarine.

3. The average size of the families in the study was 3.4 persons. Thirty of the 50 families preferred the 8 oz. package size.

4. The average price that the 50 families would be willing to pay for the 8 oz. package was \$0.29.

5. The general acceptance of the product was extremely good.

6. The general feeling of the participants was that the product was superior to margarine but it did not have the fine flavor of butter.

The author thinks that when this product is placed on the market, the consumers must be made to realize that all

of the good qualities of butter cannot be duplicated in a new product such as this. It must be portrayed that this is a new product which will stand on its own merit and should not be compared so closely to butter.

Several concentrated efforts have been made to produce an economical low-fat spread type dairy product. It is the opinion of this author that there never has been a more opportune time to place such a product on the market. Today, more than ever before, when the housewife goes shopping she is looking for a healthful food, an economical food, generally a low calorie food, and a food that will meet the taste preference of her family. The low-fat dairy spread developed at South Dakota State University can meet the above requirements.

At the present time there are no surplus dairy products. However, in the long run situation, it is entirely possible that the U. S. A. will once again be faced with surpluses of milk fat and other dairy products. It is at such times that a low-fat dairy spread would be most beneficial in expanding the total market for dairy products.

LITERATURE CITED

1. American Marketing Association. 1949. Questionnaire Preparation and Interviewer Techniques. Journal of Marketing, 14:2:410.
2. Amerine, M. A., Pangborn, R. M., and Roessler, E. B. 1965. Principles of Sensory Evaluation of Food. Academic Press, New York and London. 602 p.
3. Bartlett, Roland W. March 1966. Past Present and Probable Future of the Dairy Industry. Dairy Marketing Facts. Cooperative Extension Service. University of Illinois.
4. Bing, Franklin C. March 1952. Some Practical Problems in the Introduction of New Food Products. Food Technology, 6:91-93.
5. Bullock, D. H. Jan. 1966. A Preliminary Study of a New Low-Fat Dairy Spread. Canadian Dairy and Ice Cream Journal, 45:26.
6. Coleman, J. A. 1964. Measuring Consumer Acceptance of Foods and Beverages. Food Technology, 18:53-54.
7. Creative Research Associates, Inc. April 1966. An Exploratory Study of a New Dairy Product and Its Concept. 63 p.
8. Dairy Record. June 8, 1966. Behind the News, 67:2:18.
9. Foster, D. 1956. Psychological Aspects of Food Colors from the Consumers Standpoint. Mimeo Report 14 pp. U. S. Testing Company, Hoboken, New Jersey.
10. Gould, W. A., Stevens, J. A., Duvernay, G., Feil, J., Geisman, J. R., Product, I., and Sherman, R. 1957. Establishment and Use of a Consumer Panel for the Evaluation of Foods. Ohio Agricultural Experiment Station Research Circular 40, 1-36.
11. Gregory, Mrs. Raymond. 1952. The Consumer's Reaction Toward the Food Industry and Its Products. Food Technology, 6:66-67.

12. Grelek, W. P. M. July 23, 1935. U. S. Patent 2,009, 135. Cited in Whittier and Webb (27).
13. Kallemeyn, Norman R. 1963. Dairy Product Demand Projections to 1975: Their Impact on South Dakota's Dairy Industry. Thesis. M.S.
14. Kramer, Robert C. and Shaffer, James D. Nov. 1954. A Case for the Mail Survey. Journal of Farm Economics, 630:1105, J82.
15. Pangborn, R. M. and Leonard, S. J. 1958. Factors Influencing Consumer Opinion of Canned Bartlett Pears. Food Technology, 12:285-290.
16. Parson, C. H. Sept. 1931. U. S. Patent 1,824, 496. Cited in Whittier & Webb (27).
17. Pettersen, E. A. 1958. Market Testing and Analysis in Flavor Research and Food Acceptance. Reinhold Publishing Corporation, New York. Cited in Amerine, Pangborn, and Roessler (2).
18. Rollag, N. and Kristjanson, R. L. November 1956. Butter or Margarine. South Dakota Farm & Home Research, 8(1):12-15.
19. Schaal, A. A. 1952. Consumer Trends in New Food Products for Homemakers. Food Technology, 6:13-15.
20. Shaffer, J. D. and Quackenbush, G. G. April 1955. Consumer Purchases of Butter and Oleomargarine. Michigan State College. Consumer Panel Bulletin No. 1.
21. Tobias, J. and Tracy, P. H. 1958. Observation on Low Fat Dairy Spreads. J. Dairy Science, 41:1117.
22. U. S. D. A. 1959. Sour Cream - A Study of its Market Potential in Des Moines, Iowa. Market Research Report No. 368.
23. Weckel, K. G. December 1943. New Dairy Spread Developed. Annual Report. Agricultural Experiment Station Bulletin 461, University of Wisconsin.

24. Weckel, K. G. January 1947. Simplify Method of Making New Dairy Spread. Annual Report. Agricultural Experiment Station Bulletin 471, University of Wisconsin.
25. Weckel, K. G. June 1952. Dairy Spreads - Their Potential Market and Manufacturing Procedure. Milk Plant Monthly. 41:24-28.
26. Weckel, K. G. July 1965. Dairy Spreads. Manufactured Milk Products Journal, 56:5-6.
27. Whittier, Earle O. and Webb, Byron H. 1950. Byproducts From Milk. Reinhold Publishing Corporation, New York 18, U. S. A. 317 p.
28. Wilster, G. H. September 1946. New Things in Dairy Manufacturing. Pacific Dairy Review, 50:9-26.
29. Wood, Kenneth R. and Peryam, D. R. 1953. Preliminary Analysis of Five Army Food Preference Surveys. Food Technology, 7:248-249.

DAIRY SCIENCE DEPARTMENT

November 12, 1964

APPENDIX

Dear Friend,

The Dairy Science Department at South Dakota State University is developing a new dairy product. We feel this product has many potential uses as a spread and in cooking. It has about one-half the fat content of oleo and butter, is stable at refrigerator temperatures, and blends readily into fillers and mixes.

We are now ready to determine consumer preferences for some variations of the product. We plan to invite 50 families in Brookings to participate in this phase of our research and development. Your name was selected at random and if you are willing to participate, free samples will be brought to your home once each week for a period of 6-10 weeks beginning November 22, 1964. You will be asked to state your preferences as to color, taste, smoothness and other factors on a score sheet similar to the one enclosed. Mr. William Hoyle, a graduate student from the Dairy Science Department, will deliver the samples and collect the score sheet each week.

We will appreciate your help and cooperation in the development of this new product. You will be contacted in a few days by Mr. Hoyle at which time you can ask any questions you may have concerning this study.

Sincerely,

WILLIAM A. HOYLE & WILLIAM A. JONES
Project Leader

Enc: 1

DAIRY SCIENCE DEPARTMENT

November 12, 1965

Dear Friend,

The Dairy Science Department at South Dakota State University is developing a new dairy product. We feel this product has many potential uses as a spread and in cooking. It has about one-half the fat content of oleo and butter, is spreadable at refrigerator temperatures, and blends readily into batters and mixes.

We are now ready to determine consumer preferences for some variations of the product. We plan to invite 50 families in Brookings to participate in this phase of our research and development. Your name was selected at random and if you are willing to participate, free samples will be brought to your home once each week for a period of 8-10 weeks beginning November 22, 1965. You will be asked to state your preferences as to color, taste, smoothness and other factors on a score sheet similar to the one enclosed. Mr. Walter Wosje, a graduate student from the Dairy Science Department, will deliver the samples and collect the score sheet each week.

We will appreciate your help and cooperation in the development of this new product. You will be contacted in a few days by Mr. Wosje at which time you can ask any questions you may have concerning this study.

Sincerely,

Kenneth R. Spurgeon & Shirley W. Seas
Project Leaders

W

Enc: 1

CHARACTERISTICS OF A NEW DAIRY PRODUCT FROM DAIRY SCIENCE
DEPARTMENT, S.D.S.U.

1. This new dairy spread-type product is a semi-solid; however, it is different in many respects from other table spreads. It is made from cream, cultured milk, whey solids and non-fat milk solids with the addition of salt, stabilizers and color.
2. It is readily spreadable directly from refrigerator, but does not get too soft to spread at room temperature.
3. It is homogenized and will blend readily into doughs, batters, and with other food ingredients.
4. It has good moisture holding ability. Frostings, cakes, cookies, and other baked goods made with it tend to remain moist and soft.
5. It does not separate, but tends to remain somewhat creamy when placed on hot cakes, waffles, corn-on-the-cob, and other hot foods.
6. It has about one-half the fat content of butter or margarine, but much more milk protein and milk sugar and about 60% of the calories of these higher fat products.
7. REQUIRES REFRIGERATION FOR BEST PRESERVATION

Keep cool, but do not freeze.

It is suggested that container be kept covered when not in use to prevent drying and darkening of product.

Suggested Uses

1. As spread on bread, toast, rolls, or muffins.
2. As a sauce on cooked vegetables. It is most attractive when added to the surface of hot drained vegetables where it partially melts (not stirred in). For variety a little cheese may be grated on top of the melting spread.
3. Blended with confectioners sugar to make frostings.
4. On potatoes - baked, boiled, or mashed.
5. In waffle batter, and on the finished waffles.
6. As a sandwich base for all sandwiches.

7. In cookies and brownies.
8. In yeast rolls and baking powder biscuits and on the crust of these when removed from oven.
9. In banana bread.
10. In soups.

Not suggested for

1. Frying, or heating alone for the purpose of pouring onto vegetables.
2. Use on popped corn.

Thank you for this kindness.

Kenneth W. Spurgeon
Project Leader

Shirley W. Sees
Project Leader

Basic Evaluation of Spread Type Dairy Product

Sample	Green Brand	Orange Brand	Blue Brand
	Rating Comments	Rating Comments	Rating Comments

COLOR

FLAVOR

SMOOTH-

SPREAD ON

TOAST

SPREAD-

ADDITION

Rating Scale

Excellent Fair

Very good Poor

Good Not acceptable

Average

Preference

General Comments on this series:

DAIRY SCIENCE DEPARTMENT

November 22, 1965

Dear Friends:

For the next few weeks we shall be making lots of spread with one factor or another deliberately varied, and giving samples of them to you for your appraisal. Your interest and cooperation is appreciated very much.

We are interested especially in your impressions of the various shades of color in this particular series of samples. It will be most helpful if you will record your ratings and comments on the form below. Mr. Wosje will pick it up next week.

Thank you for this kindness.

Kenneth R. Spurgeon
Project Leader

Shirley W. Seas
Project Leader

Home Evaluation of Spread Type Dairy Product

Sample	Green Band	Orange Band	Blue Band
	Rating Comments	Rating Comments	Rating Comments

COLOR

FLAVOR

SMOOTH-
NESS ON
TONGUE

SPREAD-
ABILITY

Rating Scale
Excellent Fair
Very good Poor
Good Not acceptable
Average

Preference
General Comments on this series:

DAIRY SCIENCE DEPARTMENT

SPECIAL SURVEY FOR NEW DAIRY PRODUCT

You have been participating for 9 weeks in a household test of a new dairy product. In order to assess your reactions to this new product, we would like your answers to the

February 11, 1966

1. How often did you use the product used? (Check all applicable)

2. In what form was it used? (Check all applicable)
 a. as a spread on bread, toast, rolls or
 b. with fruit, cereal, etc.

Dear Project Participants: ed vegetables.....)

The project survey in which you have been participating is nearing completion. We have one final questionnaire to be distributed and completed. This will be brought to you during the week of February 21st., and at this time the last reports will be picked up. This questionnaire will be a short summary of your views on the new dairy product.

We have sincerely appreciated your interest and fine cooperation during this entire survey.

Sincerely,

Walt Wosje
 Graduate Assistant
 Dairy Science Dept.

WWW/m

QUESTIONNAIRE FOR NEW DAIRY PRODUCT

You have been cooperating for 9 weeks in a household test of a new dairy product. In order to assess your reactions to this new product, we would like your answers to the following questions:

1. How was this new product used? (Check all applicable ways)
 - a. As a spread on bread, toast, rolls or muffins.....()
 - b. As a sauce on cooked vegetables.....()
 - c. As an ingredient in cake icings, waffle batter, cookie batter, rolls and/or biscuits.....()
 - d. As a sandwich base similar to mayonnaise.....()
 - e. Other uses (please specify).....()

2. Which of the items checked in question 1 was the way in which most of the new product was used during the test period of the new product? (Check one)

a. ()	c. ()	e. ()
b. ()	d. ()	

-2-

3. Was the new product substituted for or used in addition to any of the following products? (Check all applicable boxes)

	<u>Substituted</u>	<u>In addition</u>
Butter.....	()	()
Margarine.....	()	()
Mayonnaise.....	()	()

4. How regularly did you use the following products prior to the study? (Check all applicable items).

	<u>Every day</u>	<u>Every other day</u>	<u>Twice per week</u>	<u>Once per week</u>	<u>Do not use each week</u>	<u>Never use</u>
Butter.....	()	()	()	()	()	()
Margarine.....	()	()	()	()	()	()
Mayonnaise....	()	()	()	()	()	()

5. In general, how would you rate this new dairy product for the following purposes? (Please check whether the product was or was not used for each purpose. When the product was used for the specific purpose please check the rating and explain why you gave the product this rating).

<u>Used</u>	<u>Not used</u>
a. Spread... () If checked indicate rating	() If checked go to b.

Excellent Good Fair Poor Very Poor

Why did you rate the product this way? _____

-3-

- b. Sauce on Used Not used
 vegetables..() If checked () If checked go
 indicate rating. to c.

Excellent Good Fair Poor Very Poor

() () () () ()

Why did you rate the product this way? _____

- c. Baking Used Not used
 ingredients..() If checked () If checked go
 indicate rating. to d.

Excellent Good Fair Poor Very Poor

() () () () ()

Why did you rate the product this way? _____

- d. Sandwich Used Not used
 base.....() If checked () If checked go
 indicate rating. to question 7.

Excellent Good Fair Poor Very Poor

() () () () ()

Why did you rate the product this way? _____

-4-

7. The test samples were packaged in 8 oz. containers. Would this quantity be enough for your family for a week if the new product was used regularly? (Check one)
- a. More than a week's supply.....()
- b. One week supply.....()
- c. Less than one week's supply.....()
8. If less than one week's supply, which of the following quantities would be preferred? (Check one)
- a. 12 ounce containers ()
- b. 16 ounce containers ()
9. Did you like the shape of the container? (Check one)
- Yes...()
- No...()
10. If no, would you prefer a package that was: (Check one)
- Square.....()
- Rectangular....()
- Oval.....()
- Other.....() Please specify shape_____.
11. Did you have any problem with the storage keeping quality of the product? (Check one)
- Yes...()
- No...()

-5-

12. What problem was encountered with the keeping quality of the product? (Please describe in detail)

15. Of the total number of persons shown in Question 14, how many are:

13. Would you be willing to buy this new dairy product if it cost: (Check one box for butter, margarine, and mayonnaise)

	Than Butter @70¢	Than Margarine 45¢	Than Mayonnaise 40¢
Under \$2.00			
15¢ more per lb....()	()	()	()
10¢ more per lb....()	()	()	()
5¢ more per lb....()	()	()	()
Over \$2.00			
The same per lb....()	()	()	()
5¢ less per lb....()	()	()	()
10¢ less per lb....()	()	()	()
15¢ less per lb....()	()	()	()
Would not buy regardless of cost.....()	()	()	()

14. What would you be willing to pay per 8 oz. unit? _____

-6-

15. How many persons are included in this household?

Number _____

16. Of the total number of persons shown in Question 14, how many are:

Under 13 years old _____

Between 13 and 20 years old _____

Between 21 and 39 years old _____

Between 40 and 59 years old _____

Over 60 years old _____

17. Is the total income of the household

Under \$3,000 _____

\$3,000 - \$6,000 _____

\$6,000 - \$9,000 _____

Over \$9,000 _____